



# Collaborating Across Boundaries to Engage Undergraduates in Computational Thinking

NSF Award # 1141170

PIs: S. Monisha Pulimood (Computer Science) and  
Kim Pearson (Journalism)

Evaluator: Diane Bates (Sociology)

The College of New Jersey



Workshop # 8 at SIGCSE 2014, Atlanta, GA

# Agenda

Introductions	15 minutes (7:00 – 7:15)
CABECT Project Overview	25 minutes (7:15 – 7:40)
Forming Connections: Brainstorming in small groups	25 minutes (7:40 – 8:05)
Break	15 minutes (8:05 – 8:20)
Implementing the Collaboration I: Brainstorming in small groups	35 minutes (8:20 – 8:55)
Implementing the Collaboration II: Brainstorming in small groups	35 minutes (8:55 – 9:30)
How can CABECT support collaborations at participants' institutions?	15 minutes (9:30 – 9:45)
Wrap-up, Paperwork and Evaluations	15 minutes (9:45 – 10:00)

# Introductions

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- Presenters

- ✓ Background
- ✓ Roles

- Participants

- ✓ Name, Affiliation
- ✓ Classes typically taught
- ✓ Have you taught a collaborative class?
- ✓ What are you expecting from the workshop?



# Collaborating Across Boundaries to Engage Undergraduates in Computational Thinking





# Hypothesis

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*To increase motivation toward, and interest in, computing careers, undergraduate students must be immersed in multidisciplinary collaborative experiences where they are creators of computational solutions and internalize the relevance of and interconnectedness between classroom learning and the community they live in.*

# Goals

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- Create an experiential and engaging learning environment to immerse computer science and non-computer science majors in computational thinking.
- Study the learning environment to articulate the processes, products, challenges and strategies that manifest creative and collaborative problem solving.

# Goals

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- Formalize a model for courses that collaborate across disciplinary boundaries and with a community partner.
  - ✓ Develop a model for collaborating in courses across disciplinary boundaries.
  - ✓ Develop a model for a meaningful sustainable collaboration with a community partner.



*<insert collaborating  
discipline here>*

Computer  
Science

Deeper Engagement  
in Computational  
Thinking

*<insert community  
partner here>*



# The Pilot Project

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- Habitat for Humanity, Trenton Area, NJ (HH) acquires properties to build houses. Often these sites are **brownfields** (contaminated with industrial wastes) and must be cleaned up prior to construction.
- Computer science students are collaborating with journalism students and HH to develop an online system called **SOAP** (**S**tudents **O**rganizing **A**gainst **P**ollution).
  - ✓ To help HH estimate costs for cleaning up properties
  - ✓ To empower citizens to learn, share, and contribute pollution data, and become active participants in environmental advocacy and public policy deliberations.



Journalism

Computer  
Science



Habitat for Humanity

# The Pilot Project

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- Builds on the cooperative expertise model of distributed CS education.
- Collaborating class sessions are held in the same timeslot but independently.
- Classes meet 3-4 times during the semester to brainstorm, share progress reports and plan next steps.
- Class visits by Tom Caruso, Executive Director of Habitat for Humanity (HH) and Nicky Sheats, Director of Center for Urban Environment (expert on environmental justice).
- Field trip to Trenton, NJ to visit HH office, acquired properties, and contaminated sites.

# The Pilot Project

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- Assignments and class projects are based on “problem”.
- CS class designs and develops modules to address concerns and needs raised by the journalism class, Dr. Caruso and Dr. Sheats.
- Journalism class researches trusted sources for data and explores new technologies and techniques for storytelling, data interpretation and improving user experience.

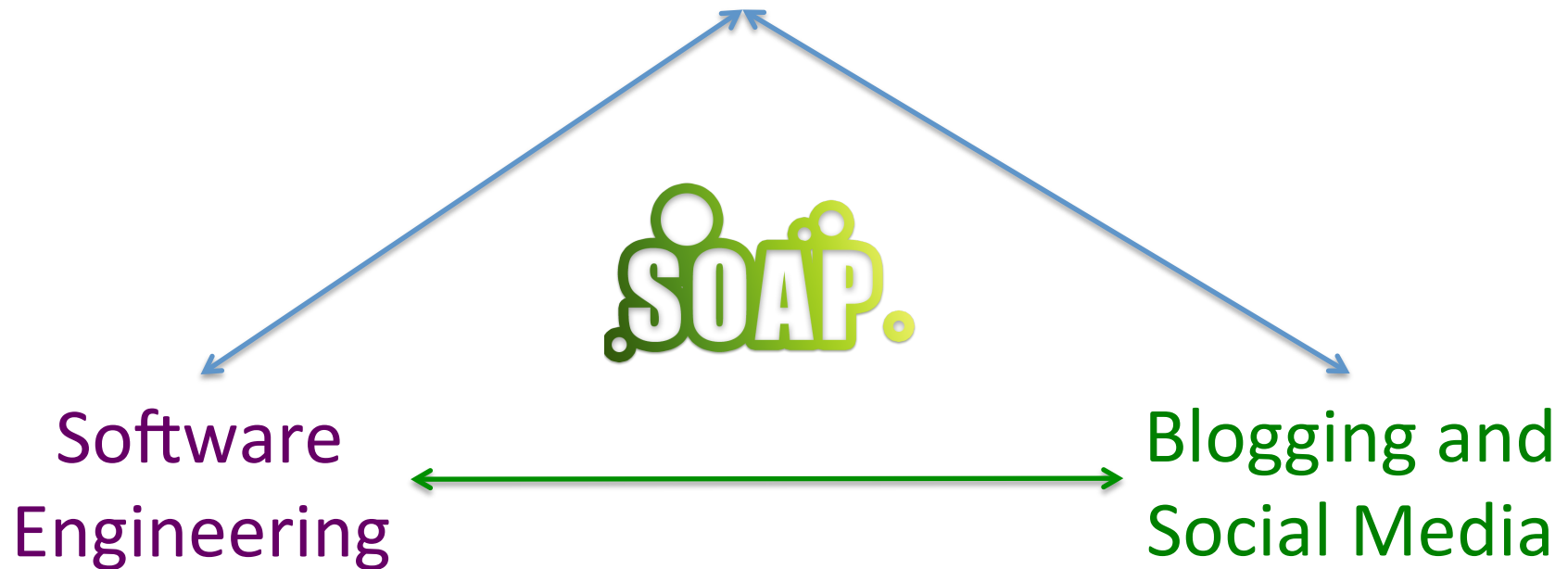


# What is a Brownfield?



# What We Did In Spring 2013

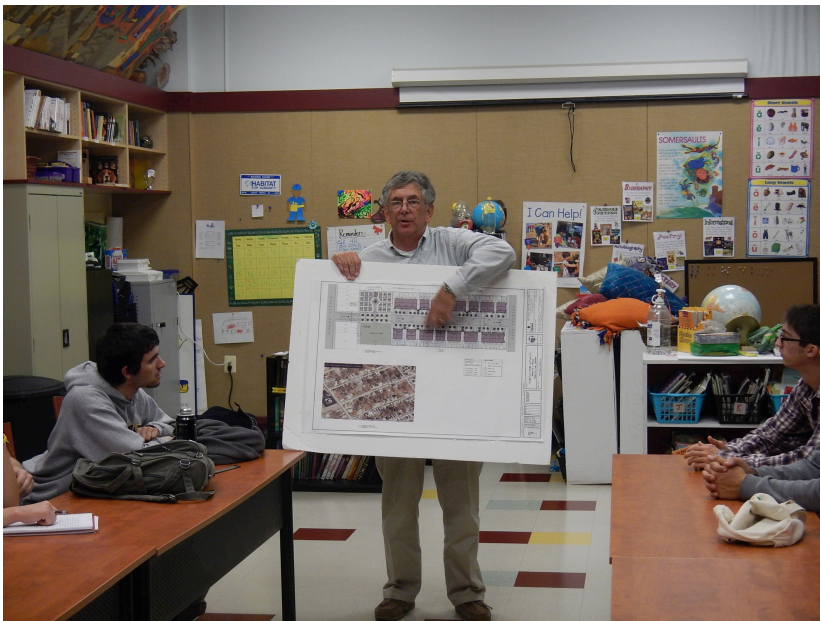
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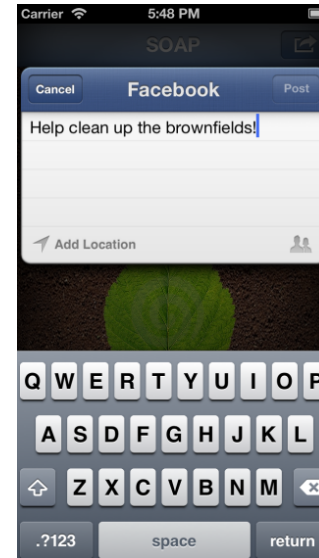
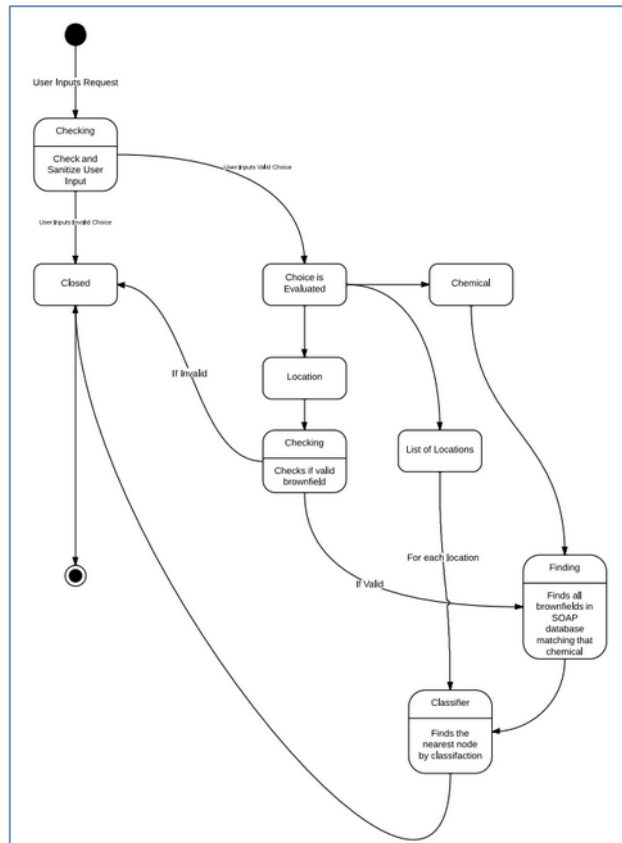


# The Pilot

- Class visits and field trips

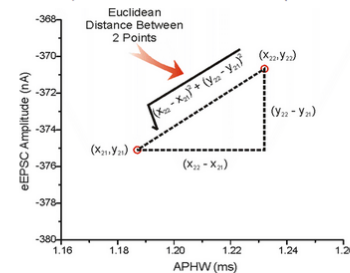


# Artifacts

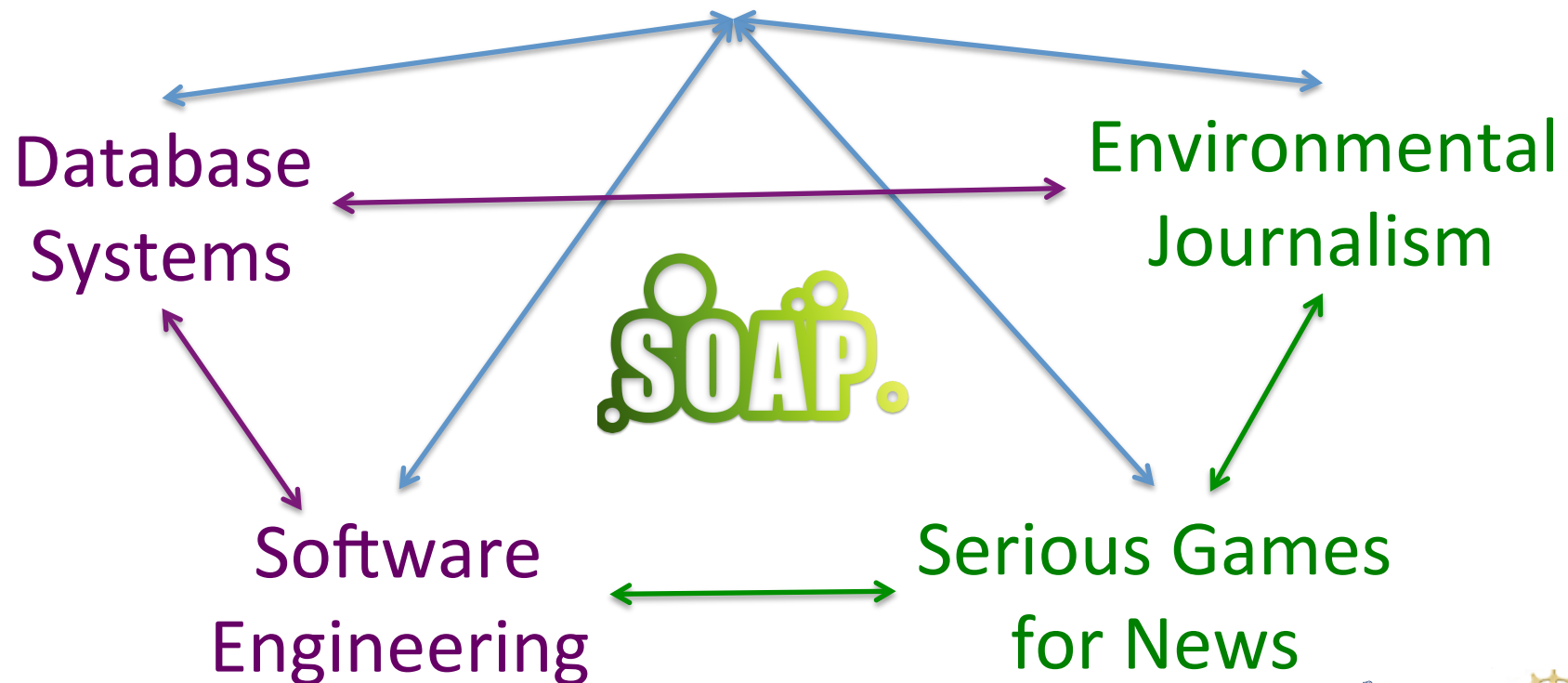


## How it works

Proof of concept - Euclidean Distance (KNN Classification)



# What We Did In Fall 2013



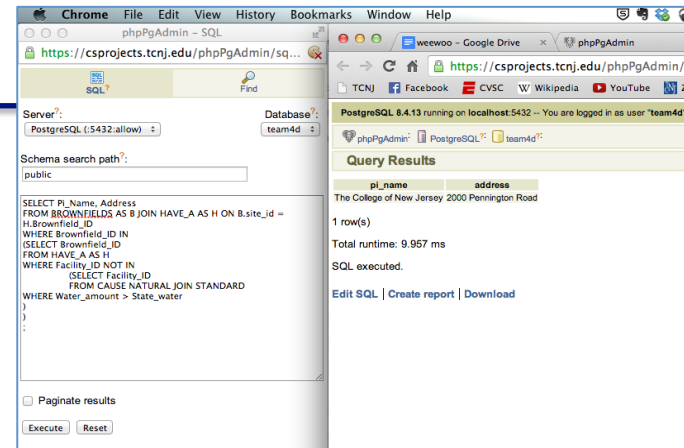
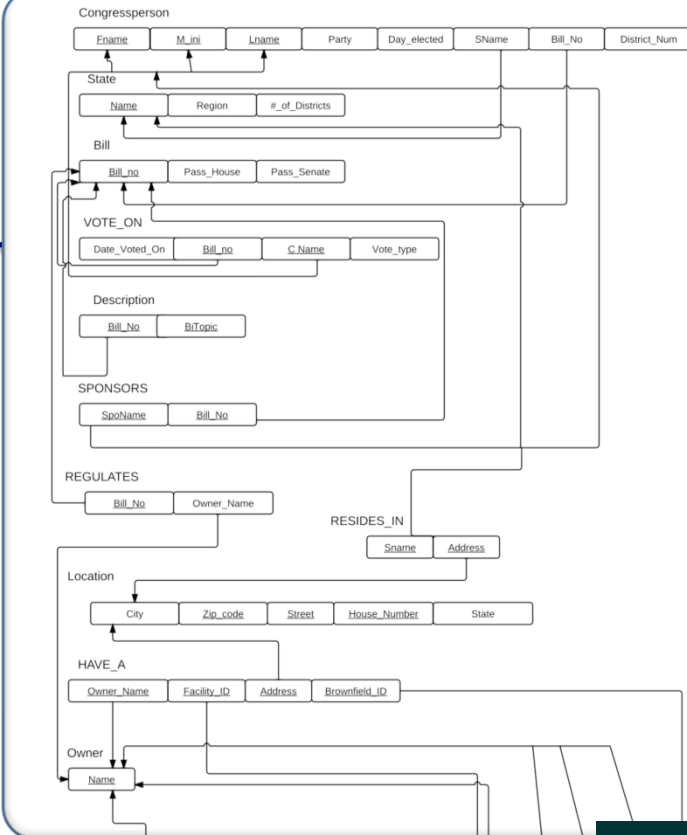








# Artifacts



SOAP

Data - Visualize - Help -

POLLUTION

Brownfields

Chemicals

Facilities

POLITICIANS

Senate

Representatives

Lobbyists

## Water Pollution

### Green

- PATRIOT MFG INC, 1000 S GRAND ST
- SOUTH JERSEY PUBLISHING CO, 1000 W WASHINGTON AVE
- DOUGHTY RD LLC, 1001 DOUGHTY RD
- 1001 TILTON RD, 1001 TILTON RD
- MARINA THERMAL FACILITY, 1077 1087 ABSECON BLVD
- The College of New Jersey, 2000 Pennington Road

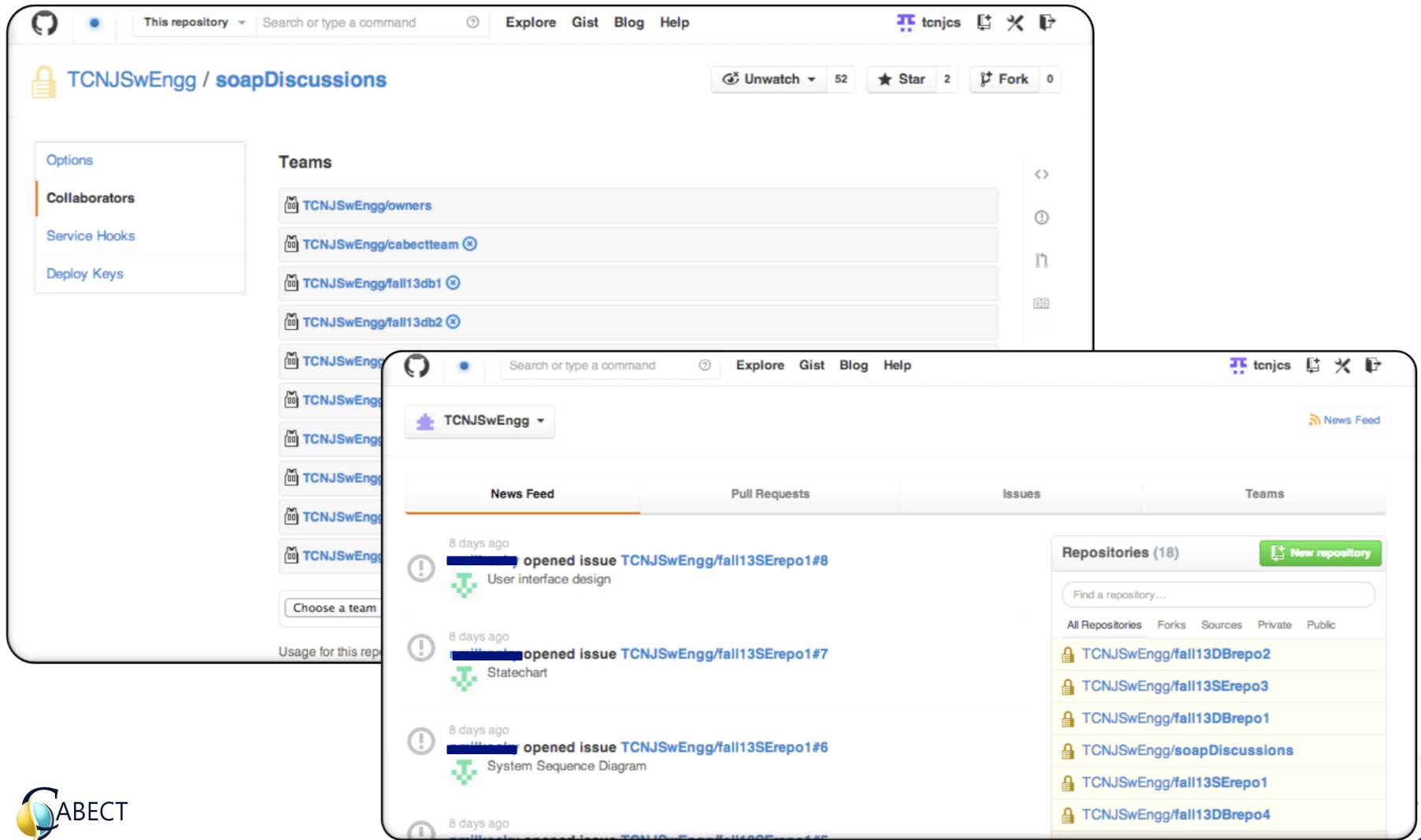
### Yellow

- WILMAD GLASS CO INC, 1002 HARDING HWY
- CASINO REINVESTMENT DEVELOPMENT AUTH, 1014 ATLANTIC AVE
- AG SUNOCO, 101 ALBANY AVE
- FERRARI OIL INC, 1020 WHITEHORSE PK
- 103 N PENNSYLVANIA, 103 PENNSYLVANIA AVE
- YELLOW\_TEST, YELLOW\_TEST

Log In



# What We Did In Fall 2013



The image shows a screenshot of a GitHub repository page for **TCNJSwEngg / soapDiscussions**. The page is divided into several sections:

- Header:** Includes the repository name, a search bar, and navigation links (Explore, Gist, Blog, Help). It also shows repository statistics: 52 Unwatch, 2 Stars, and 0 Forks.
- Left Sidebar:** Contains links for Options, Collaborators, Service Hooks, and Deploy Keys.
- Teams Section:** Lists several teams associated with the repository, including **TCNJSwEngg/owners**, **TCNJSwEngg/cabectteam**, **TCNJSwEngg/fall13db1**, and **TCNJSwEngg/fall13db2**.
- News Feed:** Displays a list of recent issues, each marked as "opened issue" and dated "8 days ago". The issues include:
  - TCNJSwEngg/fall13Serepo1#8** (User interface design)
  - TCNJSwEngg/fall13Serepo1#7** (Statechart)
  - TCNJSwEngg/fall13Serepo1#6** (System Sequence Diagram)
- Repositories (18):** A list of repositories owned by the user, including **TCNJSwEngg/fall13DBrepo2**, **TCNJSwEngg/fall13Serepo3**, **TCNJSwEngg/fall13DBrepo1**, **TCNJSwEngg/soapDiscussions**, **TCNJSwEngg/fall13Serepo1**, and **TCNJSwEngg/fall13DBrepo4**.

The CABECT logo is visible in the bottom left corner.

# What We Did In Fall 2013

Contact database for Health and Environmental Journalism

File Edit View Insert Format Data Tools Help All changes saved in Drive

	A	B	C	D
1		<b>OCCUPATION</b>	<b>Organization</b>	<b>STREET ADDRESS</b>
2	Main Press Line	Director	Center for Disease Control and Prevention	1600 Clifton Road
3	John T. Burklow	Associate Director for Communications and Public Liason	National Institute of Mental Health	Rockville Pike
4	Julie Willmot	Media Contact, Mercer County, NJ	mercer county, nj environmental sanitation division, bucks county pa	McDADE ADMINISTRATIVE BUILDING 640 SOUTH BRIDGE STREET
5	William J. Roth, B.S., S.E.O.	Bureau Director, Bucks County Supervising Environmental health specialist,	Services of Burlington county Middlesex County Public Health Department	15 Pioneer Blvd
6	Tom Fox	Environmental coordinator		75 bayard st 5th
7	Environmental coordinator			
8				

Students Organized Against Pollution

A CABECT collaboration

HOME REPORTS SUBMIT A REPORT

Filters: ALL NEWS PICTURES VIDEO

Category Filter: HIDE

ALL CATEGORIES

CONTAMINATED SITES

TRUSTED REPORTS

INCIDENT REPORTS

HOW TO REPORT

By using an app: iPhone Android

By filling this form on our website.

Facebook Twitter Email RSS + 0

From: Oct 2013 To: Oct 2013

Oct 2013

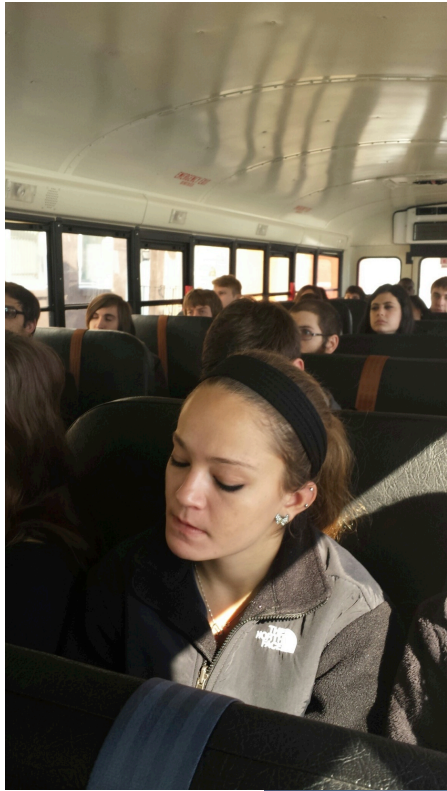
2013

18 Oct 2013 19 Oct 2013 20 Oct 2013 21 Oct 2013 22 Oct 2013

# What We're Doing In Spring 2014

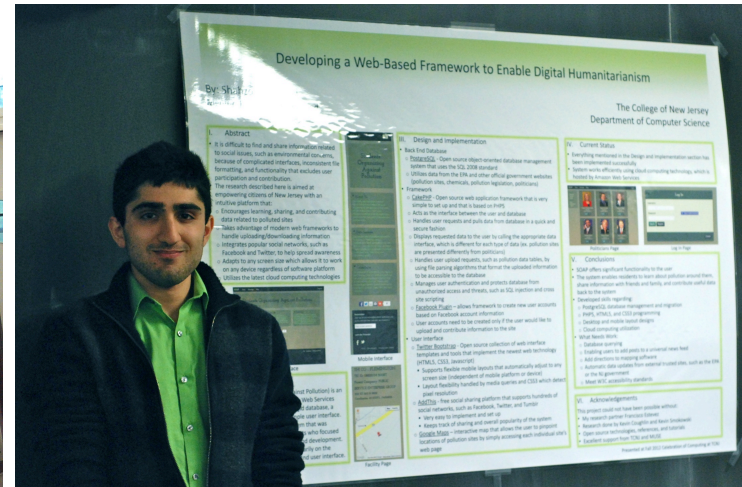
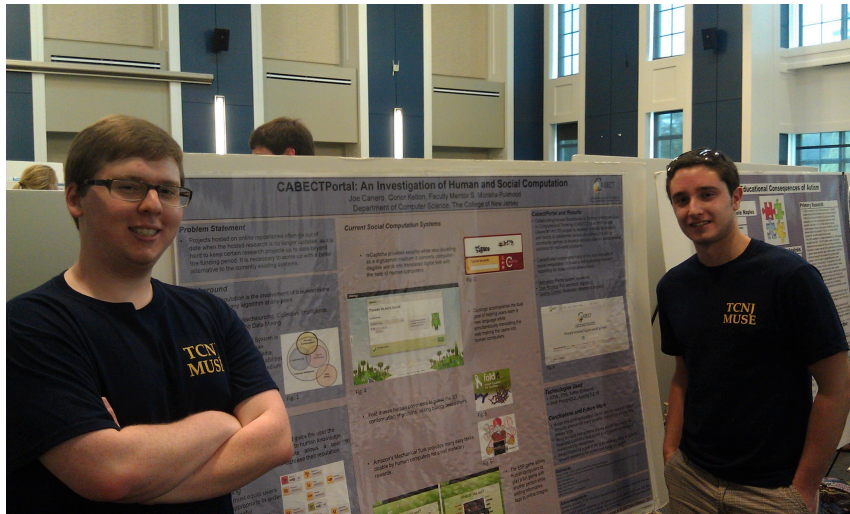
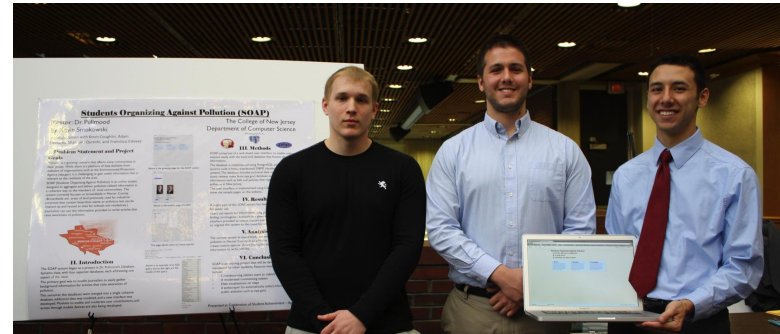
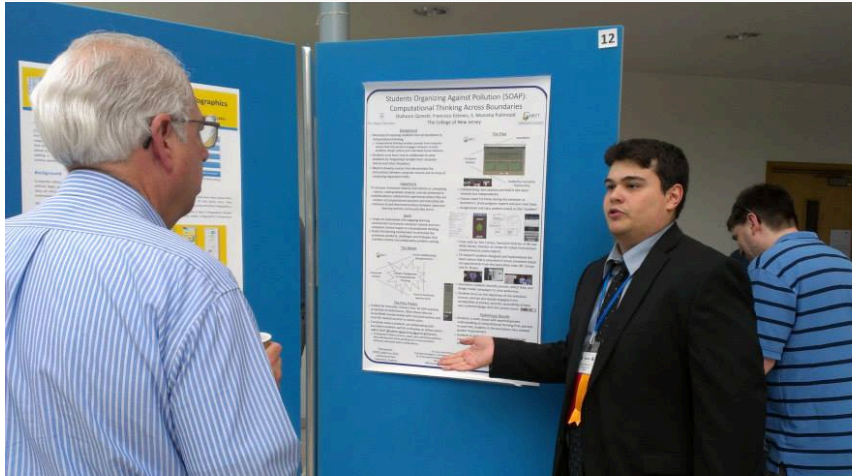
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# The Pilot



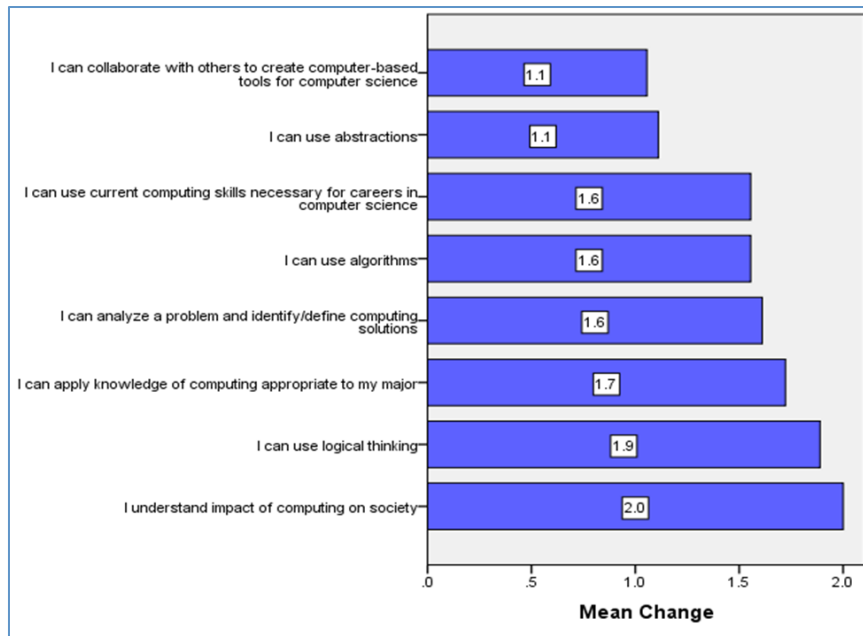
# Preliminary Results

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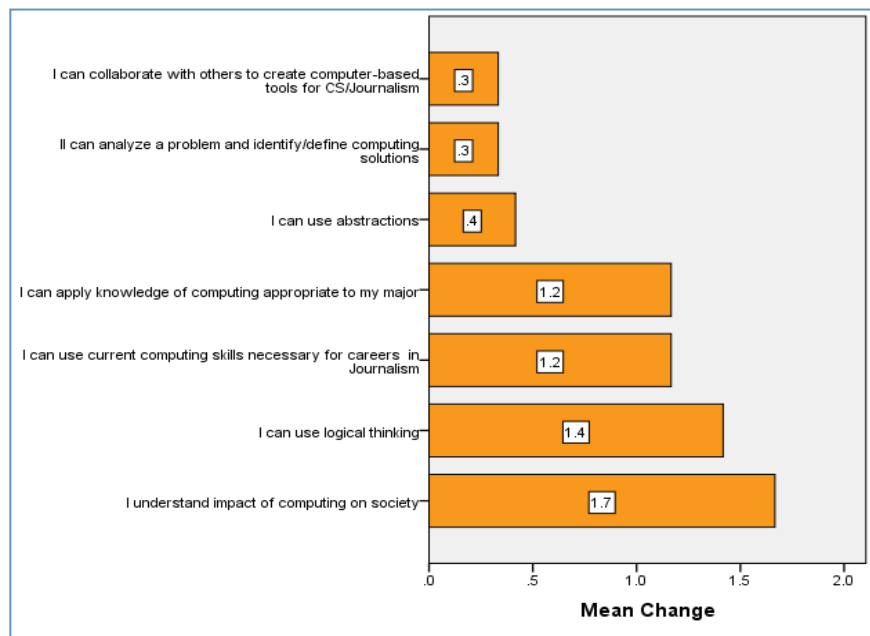
- Students in both classes self-reported greater understanding of computational thinking from pre-test to post-test.
- Students in both classes recorded highest gains in understanding how computing affects society.

# Preliminary Results

## Computer Science Students (N=21)



## Journalism Students (N=21)



Change in mean of post-test self-reported level agreement from pre-test level of agreement, measured on a 4 point scale where 4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree;

Data shows that Computer Science students demonstrated greater changes overall, with up to two points of mean change from class.

# Preliminary Results

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*“It has provided a new point of view of Computer Science that I didn't know of before. As well as thinking about design decisions in a way that is effective from the computer programmers point of view, we also need to take into account how the system will be used by others. Also, dealing with stakeholders in the system by directly asking them questions was a more effective way of laying out system requirements than just imagining what they would want.”*

*“The collaboration was helpful in learning about requirements gathering and planning the system and the user interface. It helped us learn how to balance the interests of all stakeholders and develop a solution to an important problem in the system. This is what a software engineering course is meant to teach students and I found it to be a very valuable experience.”*



# Challenges and Concerns

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- Understanding the scope of involvement and where the other class “fits”
- Students collaborating across courses beyond designated meeting times.
  - ✓ Need more meetings with the other class
  - ✓ Collaboration and meetings should be more structured
- How does the additional time for collaborative activities impact content coverage?

# Questions

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- How do you incorporate ethics into all stages of the project so that students are constantly aware of needing to make ethical decisions?
- What kinds of collaborative activities make sense?

# Obstacles / Challenges

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- Time
  - ✓ To develop the course
  - ✓ To cover content
- Keeping faculty engaged / committed
- Finding a community partner
- Institutional support

# Outcomes for the Community Partner

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- Students develop a sense of personal social responsibility.
- The partner gets applications that enable them to efficiently carry out tasks.
- The partner gets informative online resources that promote a better understanding in the community about the issues being investigated and addressed.

# Forming Connections

Brainstorming in small groups – 25 minutes

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- What kinds of projects in your course(s) might work for this model?
- To which faculty members and disciplines can you reach out?
- To which community partners can you reach out?
- What institutional support is available?
- What additional institutional support is needed?
- Regroup and report out

# Break – 15 minutes

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## Questions

# Implementing the Collaboration I

Brainstorming in small groups – 35 minutes

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- Specific concerns
  - ✓ Logistics
  - ✓ Administrative support
  - ✓ Others ??
- How we addressed them
- Ideas on how these can be addressed
- Regroup and report out

# Implementing the Collaboration II

Brainstorming in small groups – 35 minutes

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- Identifying learning goals and outcomes
- Specific concerns
  - ✓ Adapting existing courses
  - ✓ Scheduling courses
  - ✓ Getting students on board, etc.
- How we addressed them
- Ideas on how these can be addressed
- Regroup and report out



# Outcomes for Computer Science

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- Students develop a strong foundation in applying computational thinking to solve real-world problems.
- Students develop the ability to recognize and articulate the interconnectedness of CS with other disciplines.
- We develop a model for computational thinking infusion.

# Outcomes for Journalism

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- Students can describe similarities between the process of doing journalism and that of developing software.
- Students recognize the need for computational thinking in their own discipline.
- We see a positive impact on the accuracy, timeliness, rhetorical velocity and amplification effects of student journalism.

# Outcomes for the Institution

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- Interdisciplinary and faculty-student collaborations are formed, that do not require team-teaching or new course development.
- Courses are developed where students apply knowledge gained from academic experiences to community life and take responsibility for active and engaged citizenship in a complex and diverse society .

# Assessing Outcomes

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- Self assessments
  - ✓ First Day of Class
  - ✓ Middle of the semester
  - ✓ At the end of the semester
- Project

# How can you be involved in CABECT?

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- Sign up to be an adopter of the model.
- Recruit a faculty collaborator from another discipline, preferably non-STEM.
- Identify a community partner to work with.
- Adapt and apply the model.
- Provide us with anonymized assessment data and feedback on the model.
- Post your ideas and resources on CABECTPortal.

# What Help Can We Provide?

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- Best practices for developing similar collaborations at your institution.
  - Pitfalls to be avoided and how to deal with them.
  - Instructional materials for the courses in our project.
  - Assessment and evaluation instruments with instructions on adapting and administering them.
  - Documentation and configuration scripts for using the technology needed for such collaboration.
- “Hand-holding” throughout the process.

# Wrap-up – 15 minutes

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Questions